KAERI

지능형컴퓨팅 연구실 소개

한국원자력연구원 유 용 균
(ygyu@kaeri.re.kr, yoyogo@gmail.com)

Korea Atomic Energy Research Institute

원자력연구원의
인공지능 전문가 구성

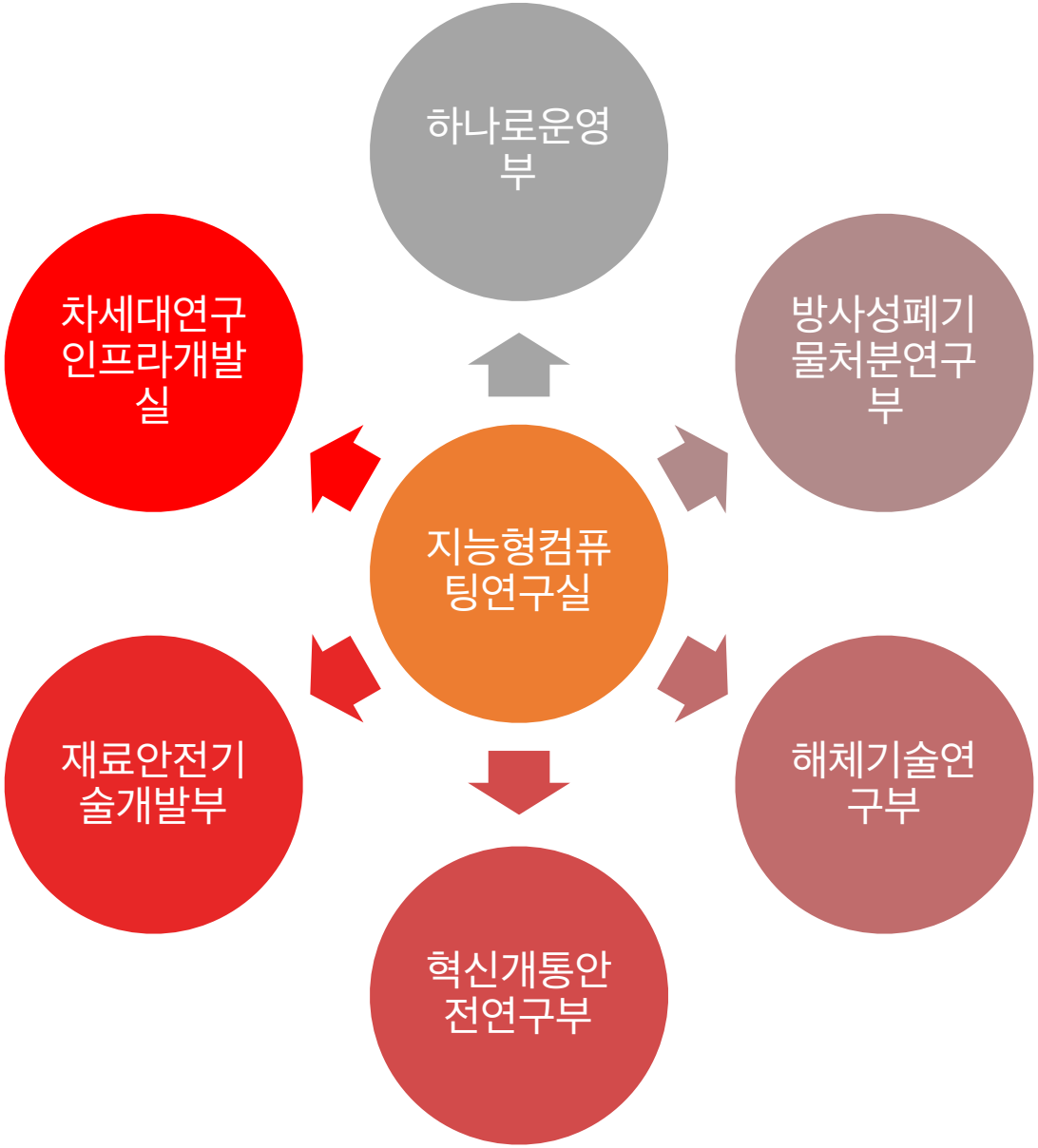
인공지능 전문가
(10~20명)

최신인공지능 기술
인공지능 기반 수학이론
핵심 인공지능 기술 고도화
인공지능 연구 지원
대형 계산장비 지원

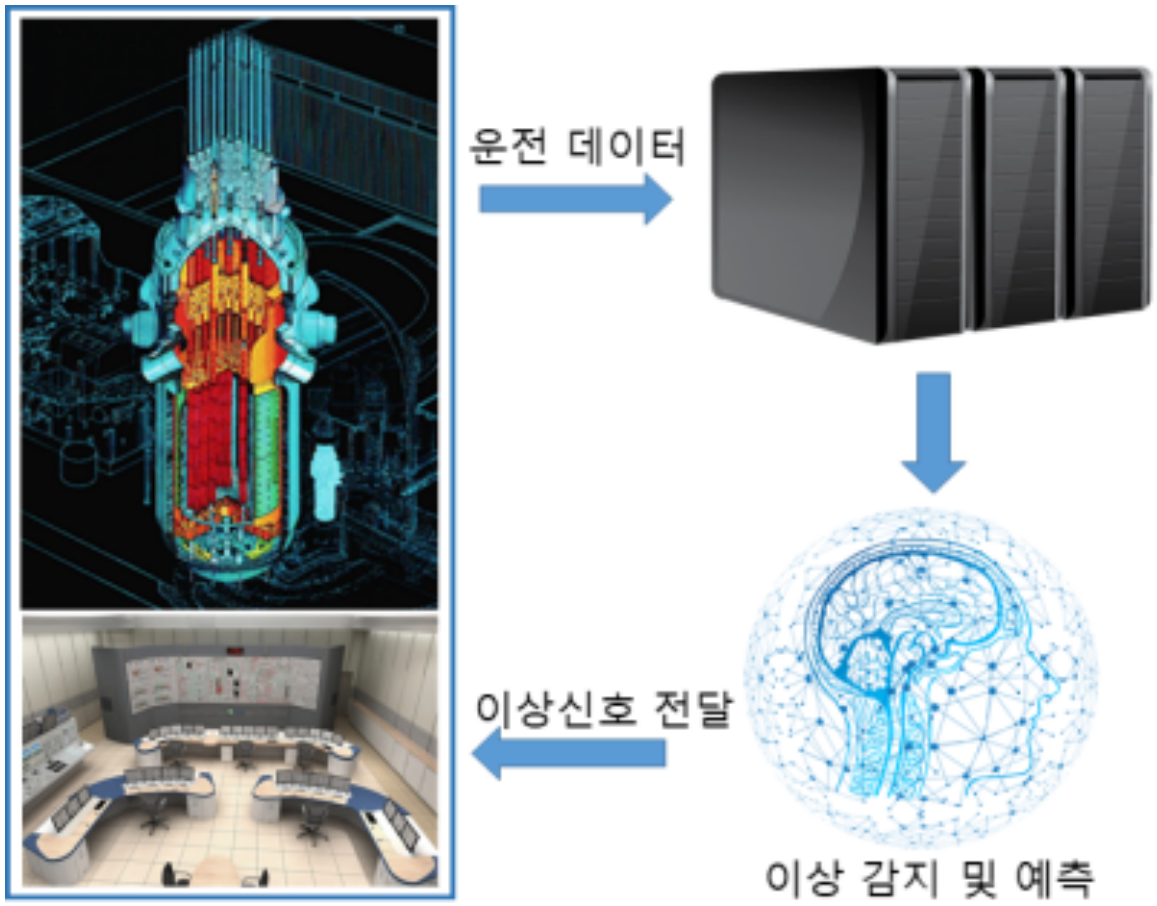
인공지능 사용자
(100명)

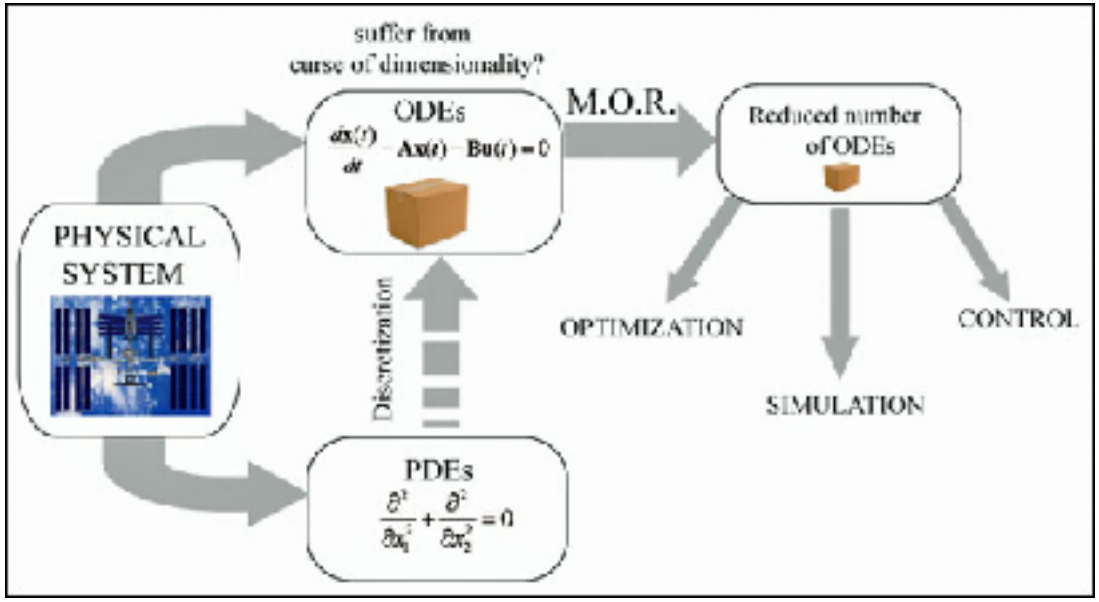
오픈 소스 및
인공지능 Framework 사용자

기존 연구부서

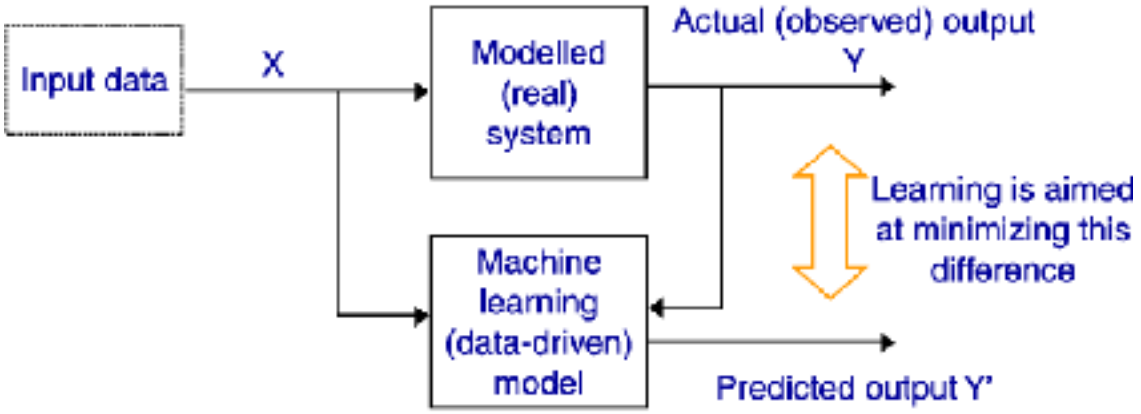

하나로운영부
방사성폐기물처분연구부
해체기술연구부
혁신개통안전연구부
재료안전기술개발부
차세대연구인프라개발실
지능형컴퓨팅연구실

하나로 운전데이터 분석





물리모델 기반 Reduced Order Model

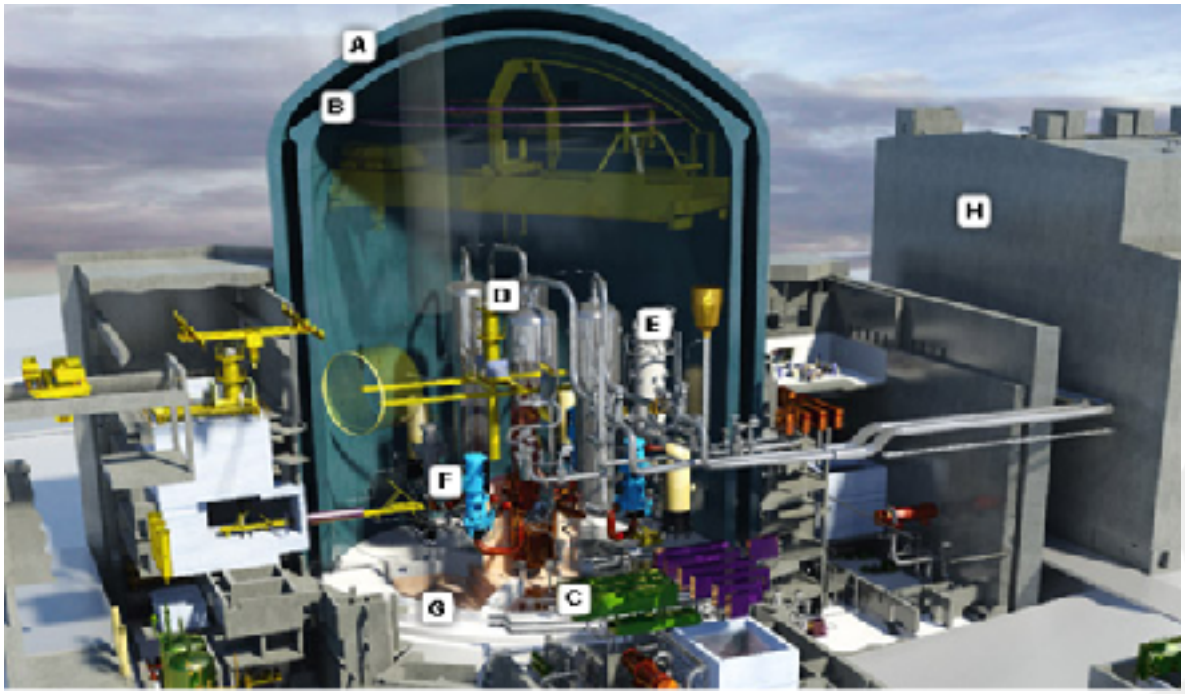


Data 기반 Reduced Order Model

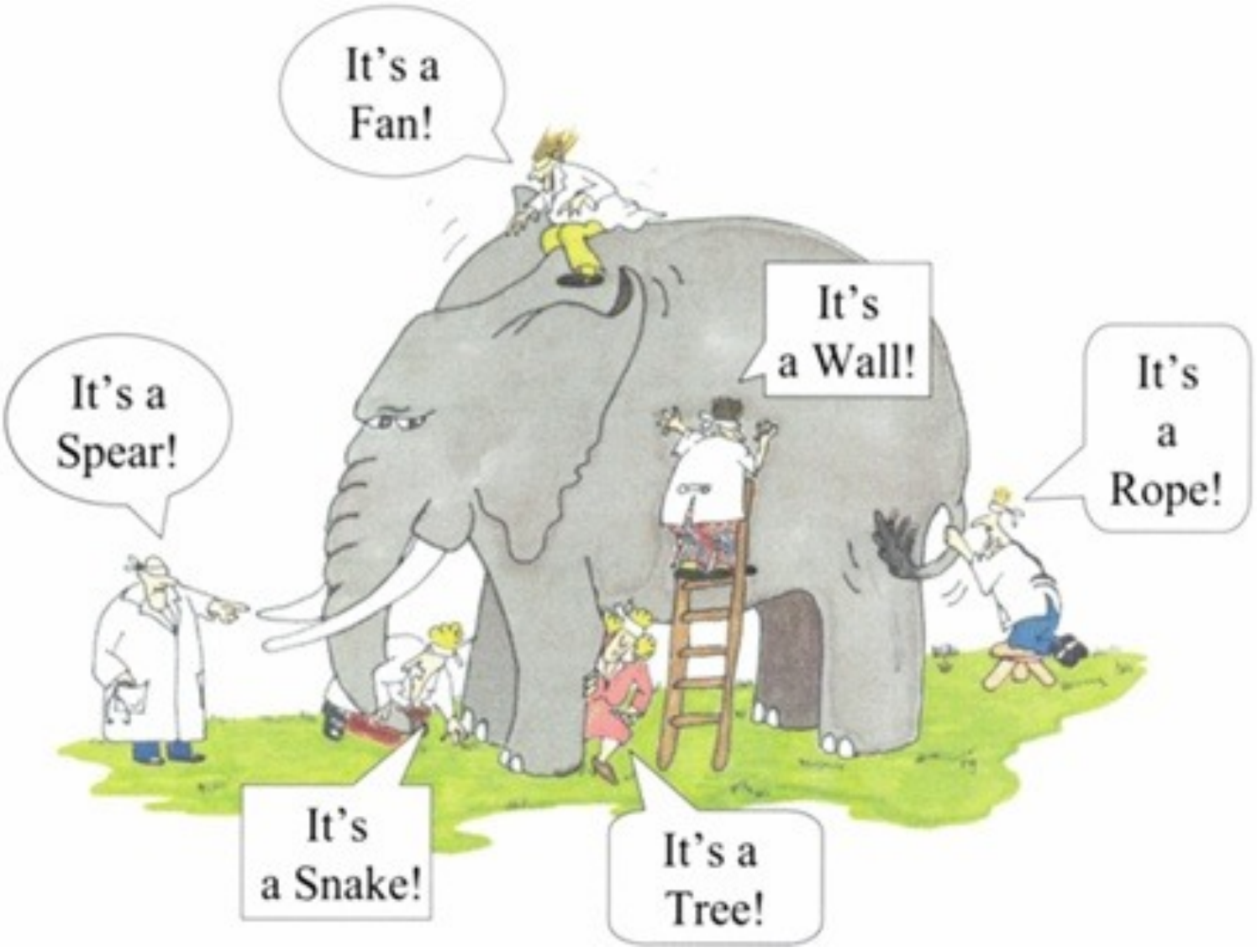
Data-driven modelling: some past experiences and new approaches
https://www.elitenetzwerk.bayern.de/elitenetzwerk-home/forschungsarbeiten/ingenieurwissenschaften/2010/castane-selga-orderreduction/

원자로의 Digital Twin을 이용한 사고 대응

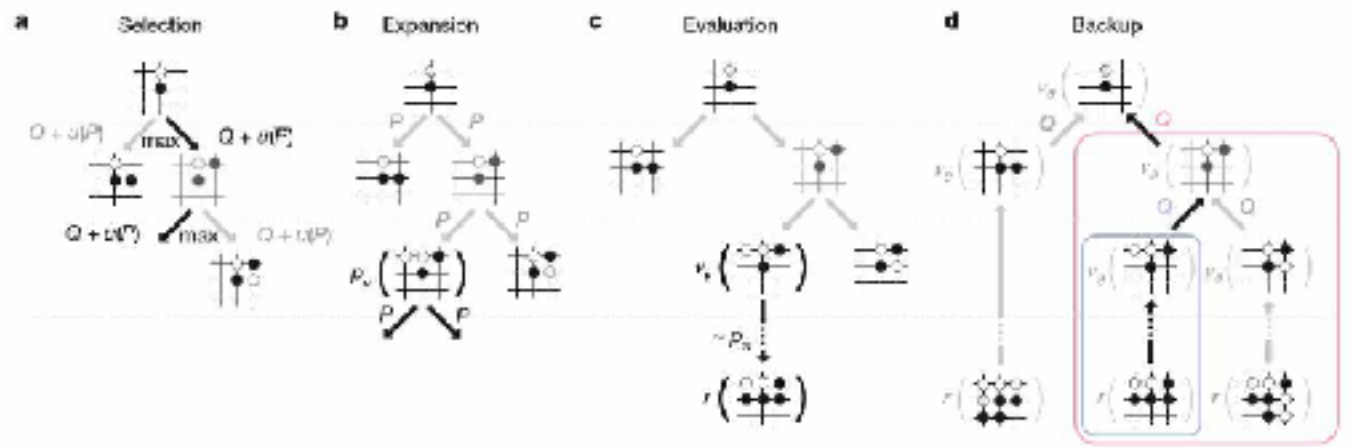
- 후쿠시마 사고와 같은 상황에도 안전한 원자로



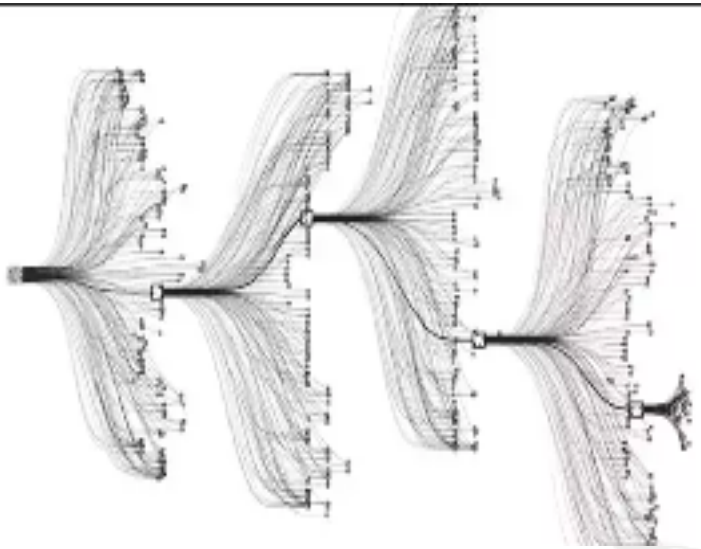
http://www.corys.com/en/steps/article/digital-twin-challenge-nuclear-power-plants


It's a Fan!
It's a Spear!
It's a Wall!
It's a Rope!
It's a Snake!
It's a Tree!

중대사고 대응



Decision1 Decision2 Decision3 Decision4



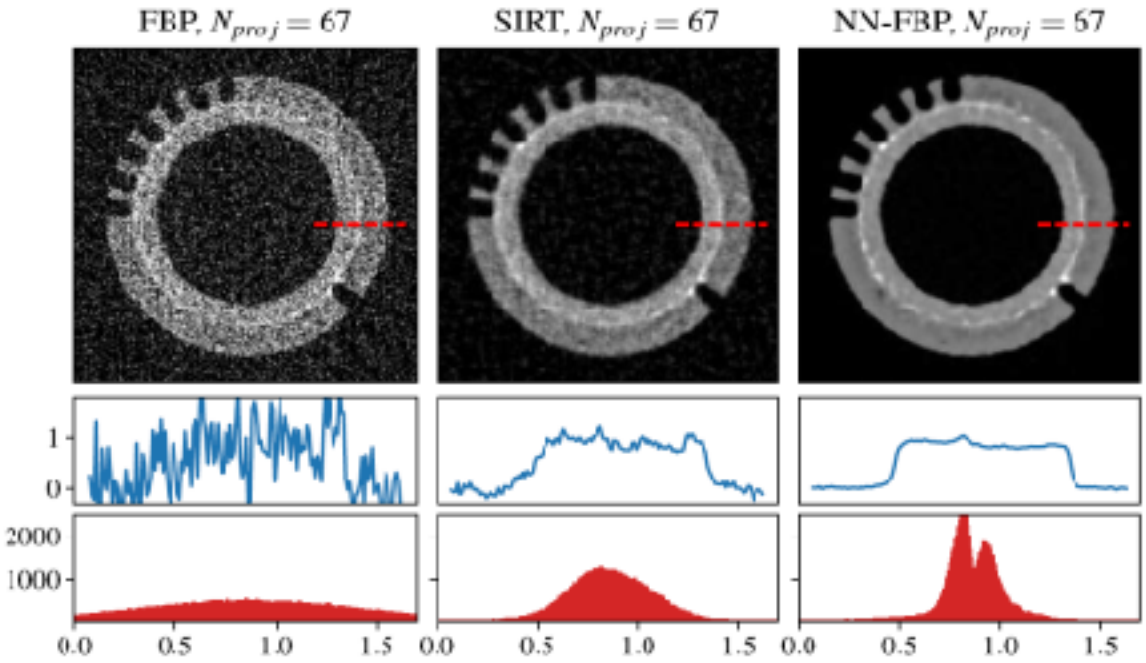
사고발생

Safe or
Not ?

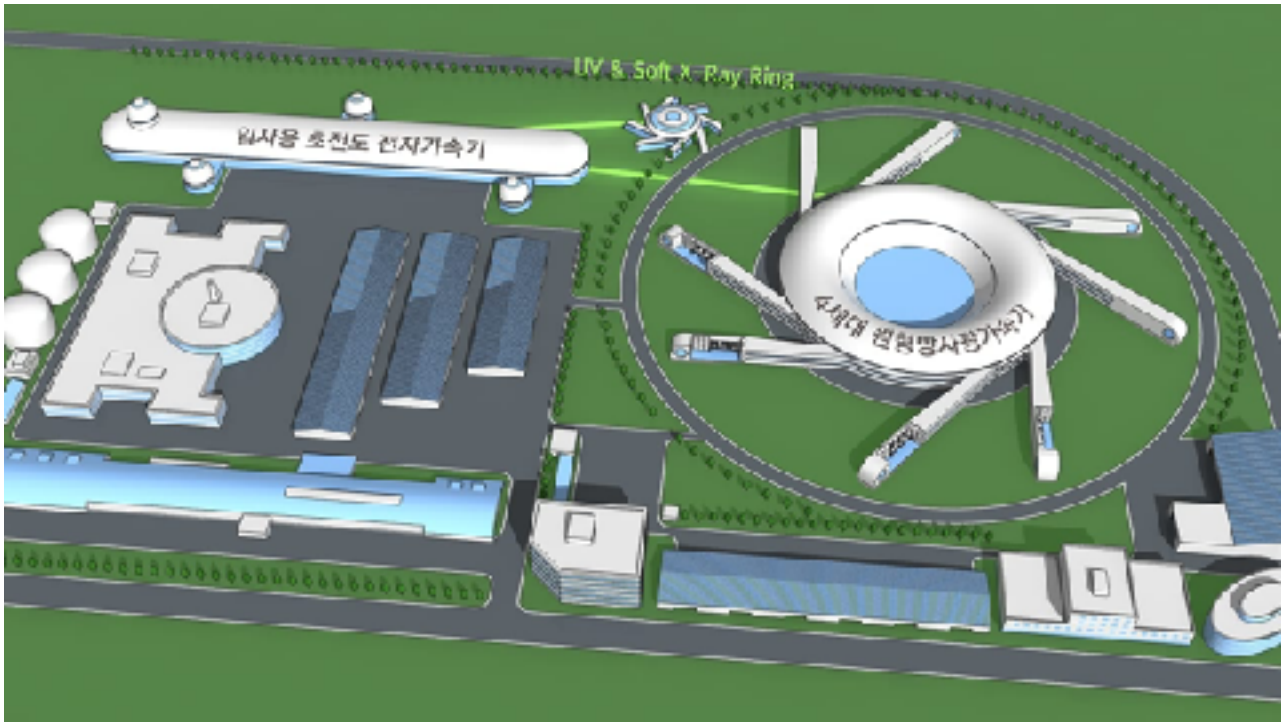
* 리스크신뢰도평과연구실

인공지능 기반 폐기물 자동 분류

머신러닝을 통한 고성능 중성자 이미징 기술 개발



가속기 + ML

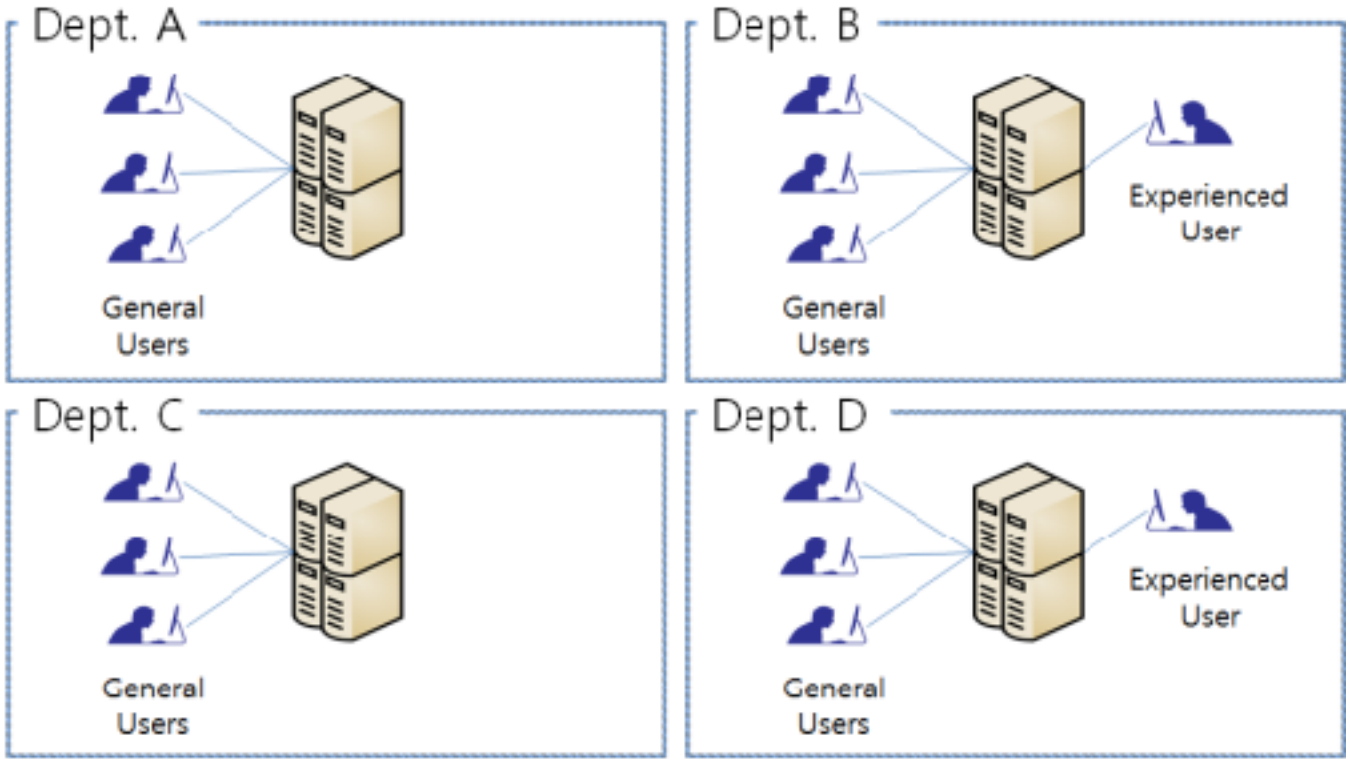


3rd ICFA Beam Dynamics Mini-Workshop on Machine Learning Applications for Charged Particle Accelerators

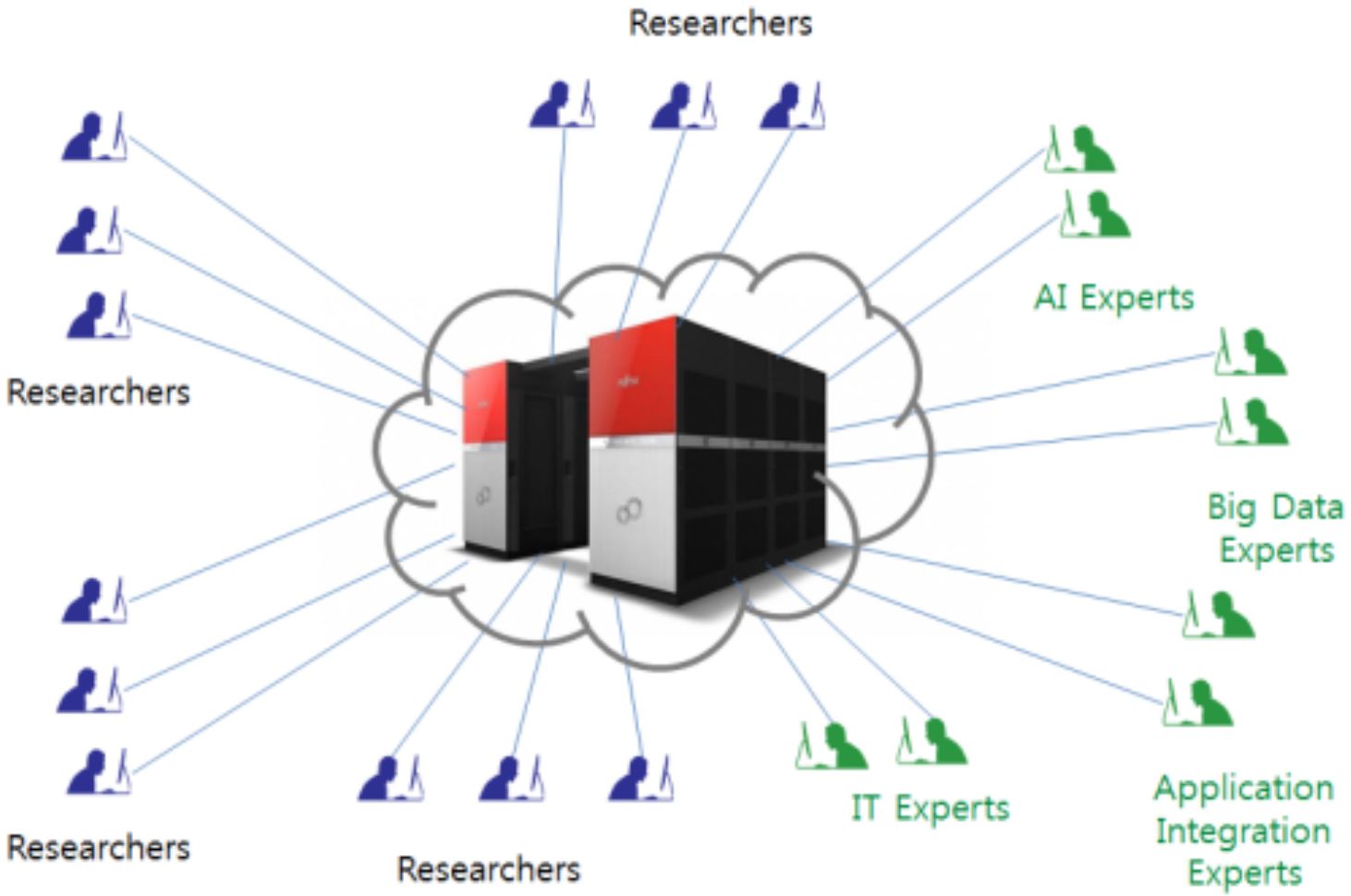
18-21 February 2020
Pohang Accelerator Laboratory, POSTECH, Pohang, South Korea
Asia/Seoul timezone

기존 IT기반 연구조직

AS IS



연구 IT 부서 역할


Researchers
Researchers
AI Experts
Big Data Experts
Application Integration Experts
IT Experts
Researchers
Researchers

지역사회 공헌

인천시-KISTI, 데이터 기반 도시문제 해결 '맞손'

김룡식 | 승인 2018.07.26 14:20 | 댓글 0

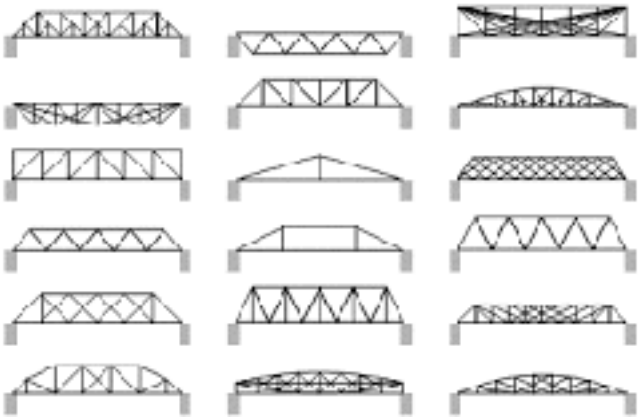
폭우 인명사고 재산피해 대비 도시침수예측 시스템 개발

박남춘 인천광역시장이 26일 시청 접견실에서 열린 인천광역시-한국과학기술정보연구원 업무협약식에서 협약 체결 후 기념촬영을 하고 있다(사진=인천시 청계공)

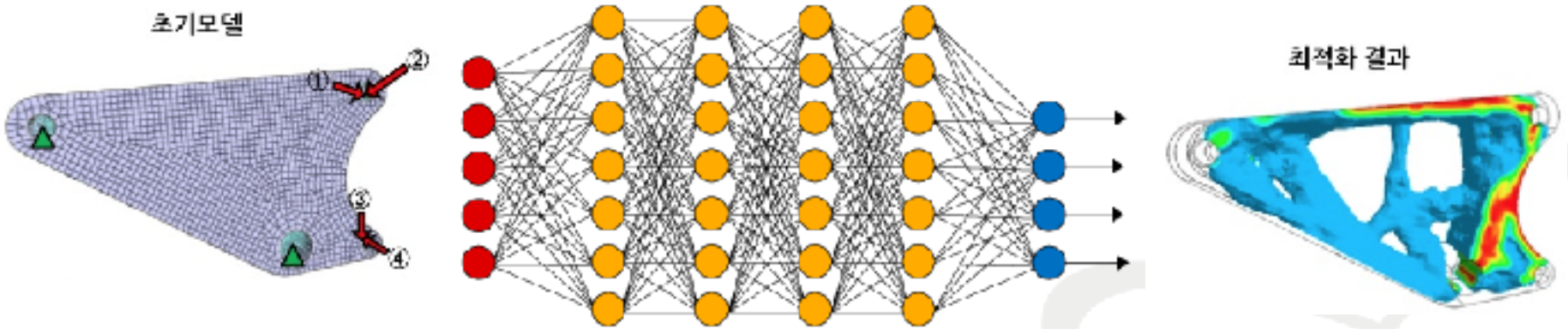
아동그림 심리분석 인공지능(나무와숲)

개인 관심사…

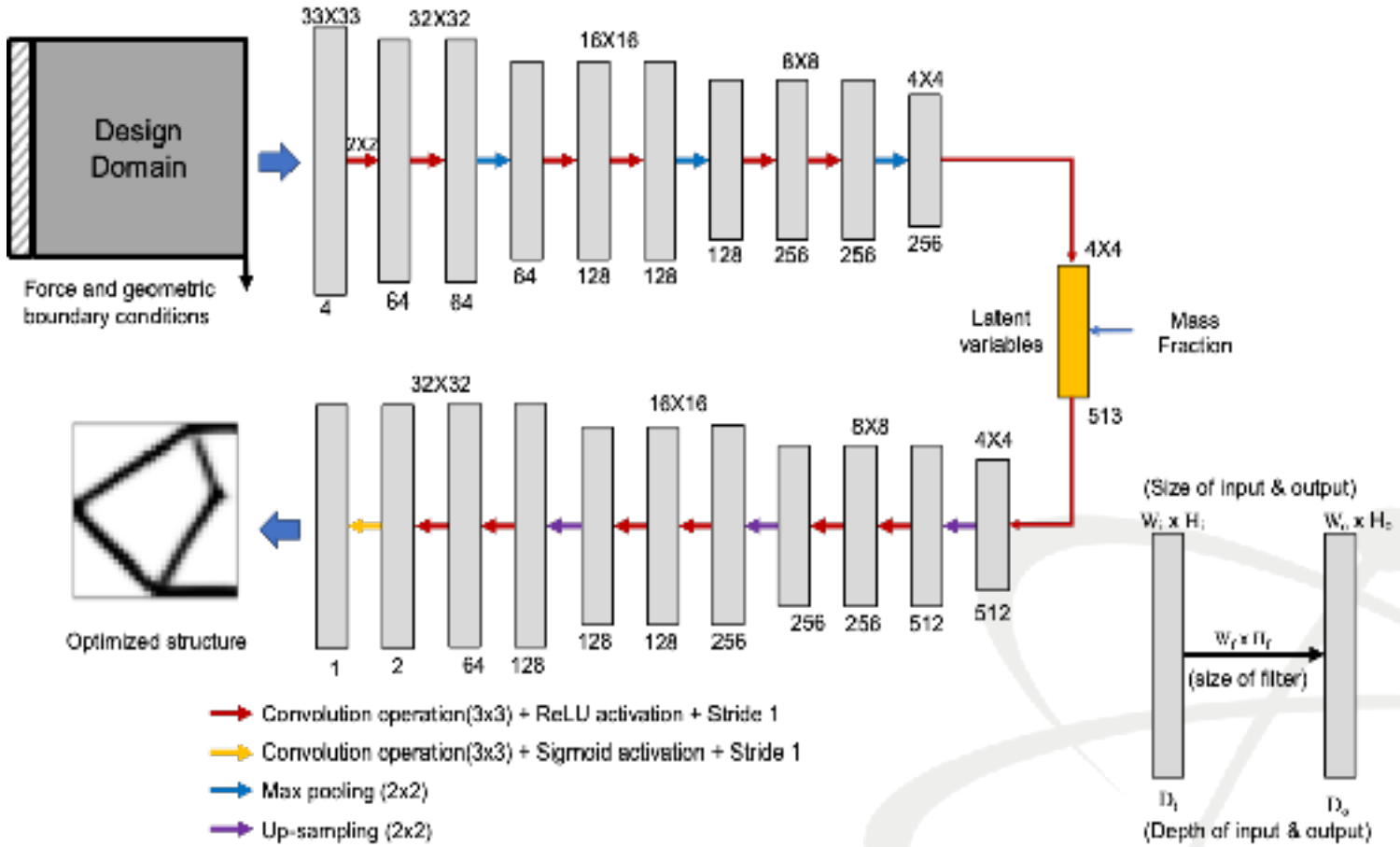
기존 설계로부터 설계의 원리를 배운다면?



AI가 최적설계를 대신해줄 수 없을까?

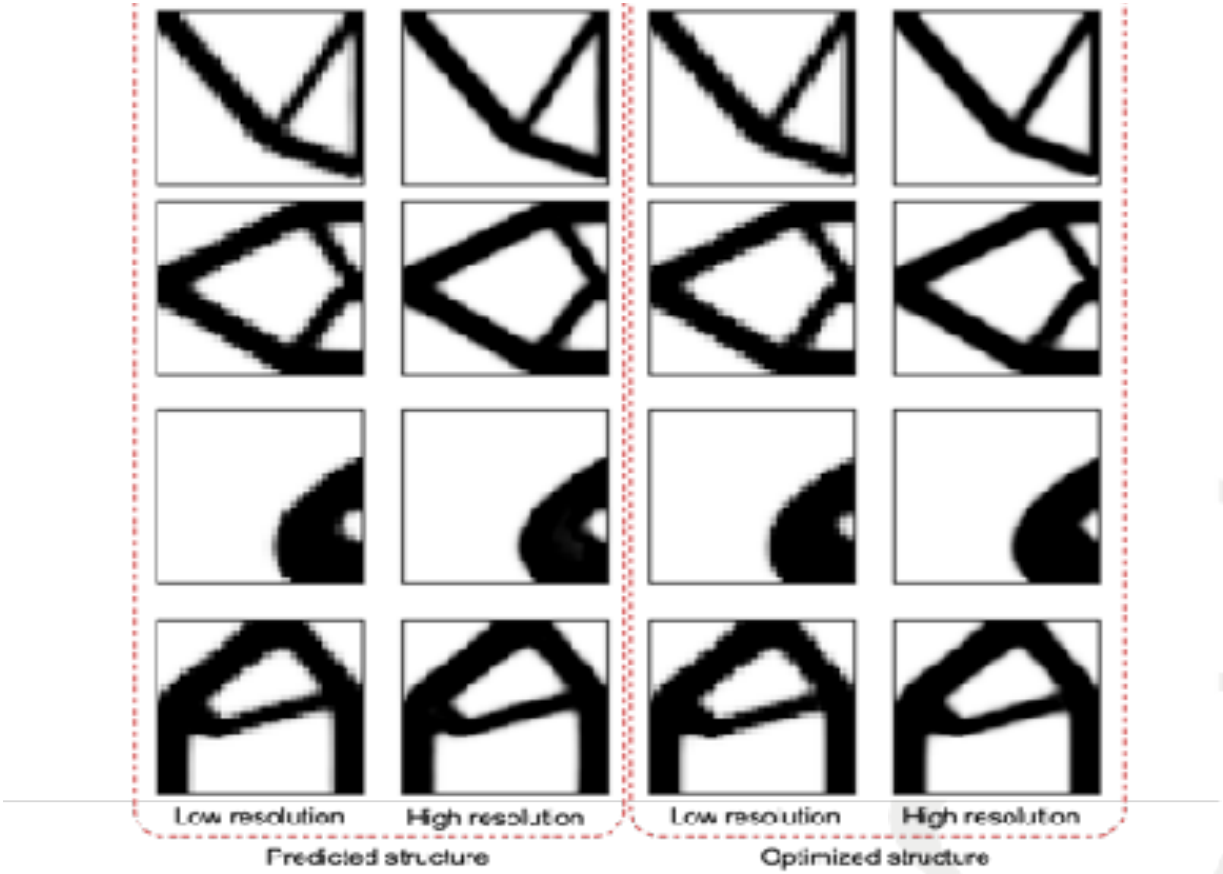


Deep Learning for Topology Optimization Design : 1st Stage



https://arxiv.org/abs/1801.05463

Deep Learning for Topology Optimization Design



https://arxiv.org/abs/1801.05463

Structural and Multidisciplinary Optimization
https://doi.org/10.1007/s00158-018-2101-5

RESEARCH PAPER

Deep learning for determining a near-optimal topological design without any iteration

Yonggyun Yu[1] · Taeil Hur[2] · Jaeho Jung[1] · In Gwun Jang[3]

Received: 3 December 2017 / Revised: 17 August 2018 / Accepted: 17 September 2018

Abstract

In this study, we propose a novel deep learning-based method to predict an optimized structure for a given boundary condition and optimization setting without using any iterative scheme. For this purpose, first, using open-source topology optimization code, datasets of the optimized structures paired with the corresponding information on boundary conditions and optimization settings are generated at low (32 × 32) and high (128 × 128) resolutions. To construct the artificial neural network for the proposed method, a convolutional neural network (CNN)-based encoder and decoder network is trained using the training dataset generated at low resolution. Then, as a two stage refinement, the conditional generative adversarial network (cGAN) is trained with the optimized structures paired at both low and high resolutions and is connected to the trained CNN-based encoder and decoder network. The performance evaluation results of the integrated network demonstrate that the proposed method can determine a near-optimal structure in terms of pixel values and compliance with negligible computational time.

Keywords Deep learning · Machine learning · Topology optimization · Generative model · Generative adversarial network · Convolutional neural network

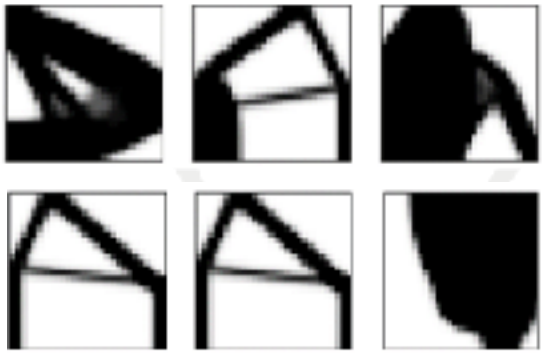
SIMP + ML ?

Optimization Scheduler

기존 최적설계

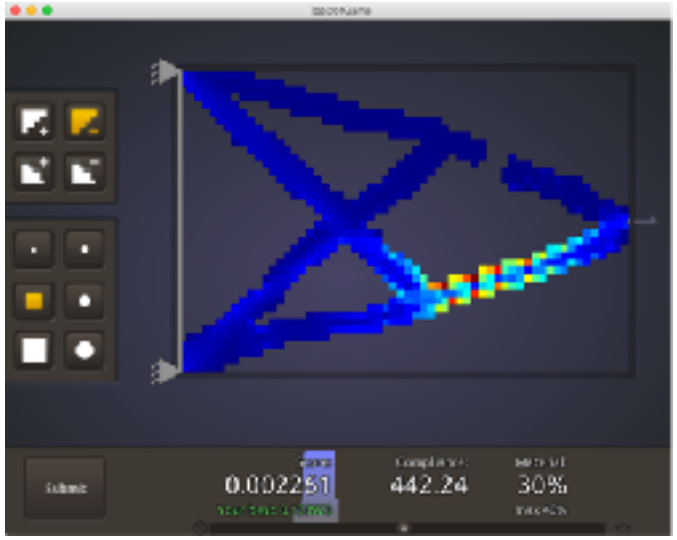
$$\frac{\partial c}{\partial x_e} = -p(x_e)^{p-1}\ \mathbf{u}_e^T\ \mathbf{k}_0\ \mathbf{u}_e$$

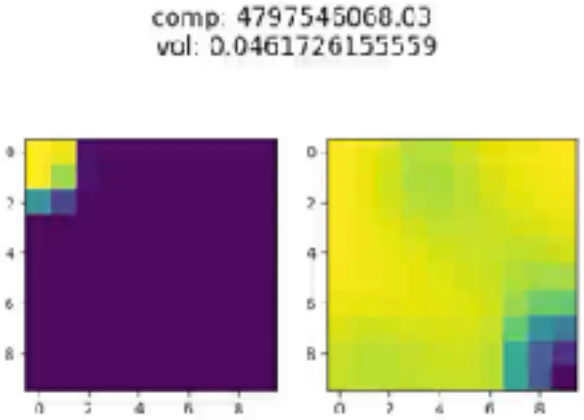
머신러닝 알고리즘

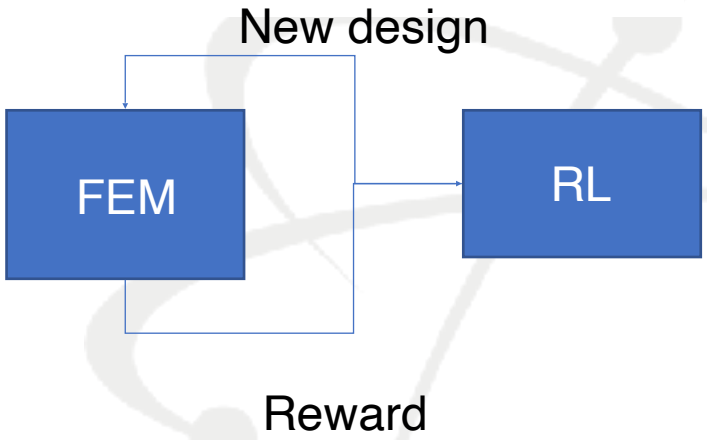


Reinforcement Learning to Topology Optimization

어디에 구멍을 뚫고 채울 것인가??





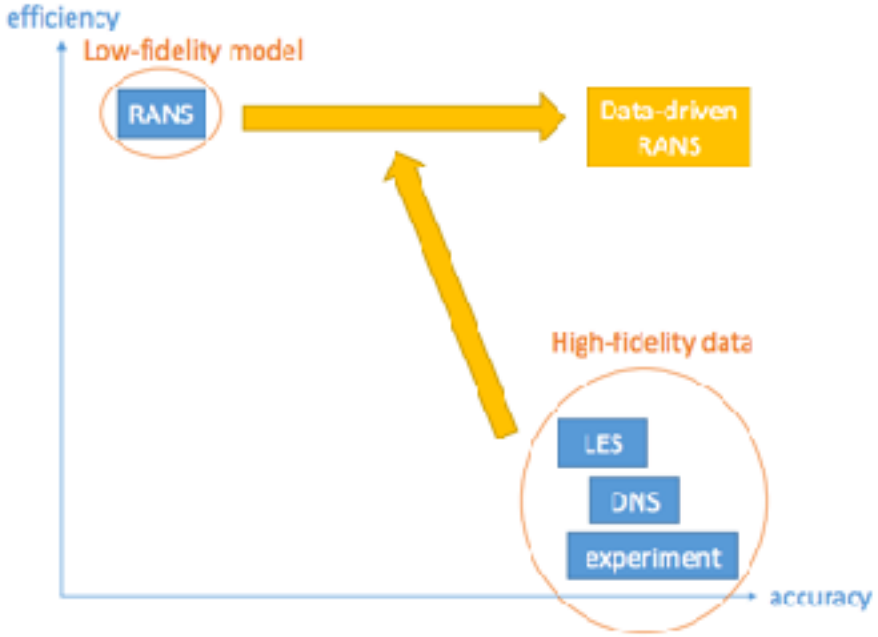


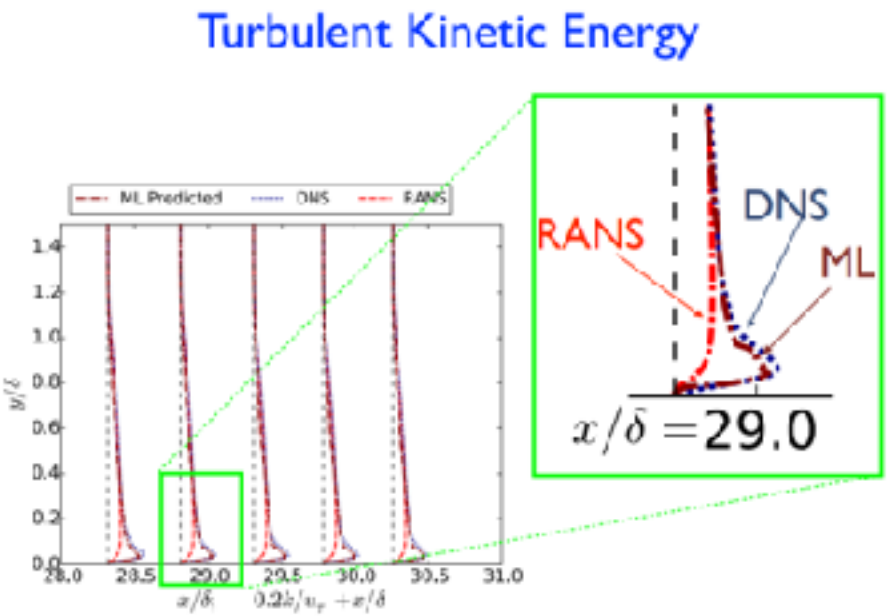
Autodesk Generative Design

AUTODESK

How a 3D-Printed Sub Could Revolutionize Nuclear Energy

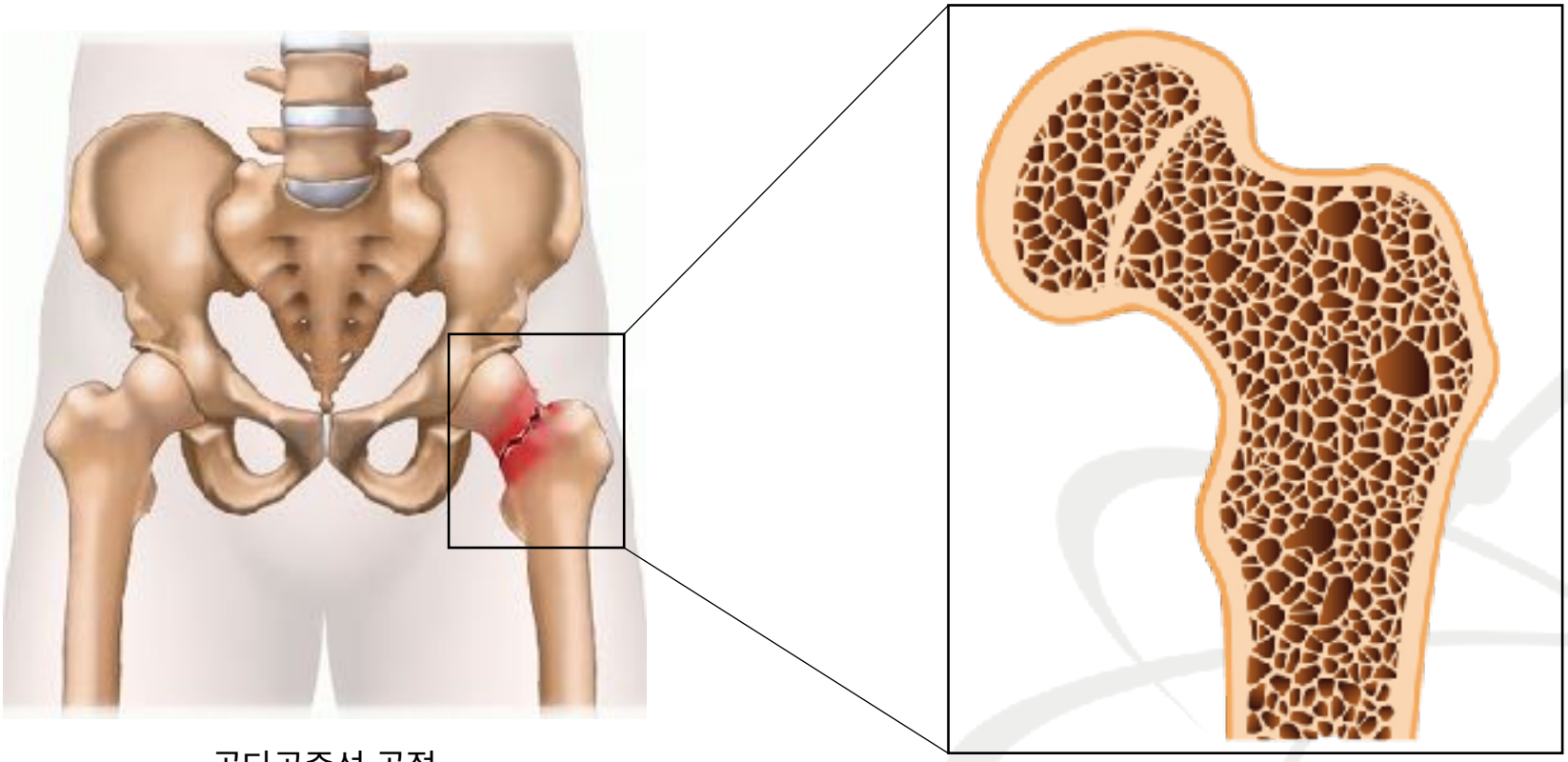
Duraisamy, A comprehensive physics-informed machine learning framework for predictive turbulence modeling





골다공증이란?

- 골량 감소 및 골질 악화로 인해 **골 강도가 감소**하여 **골절 위험성이 증가**하는 골격계 질환

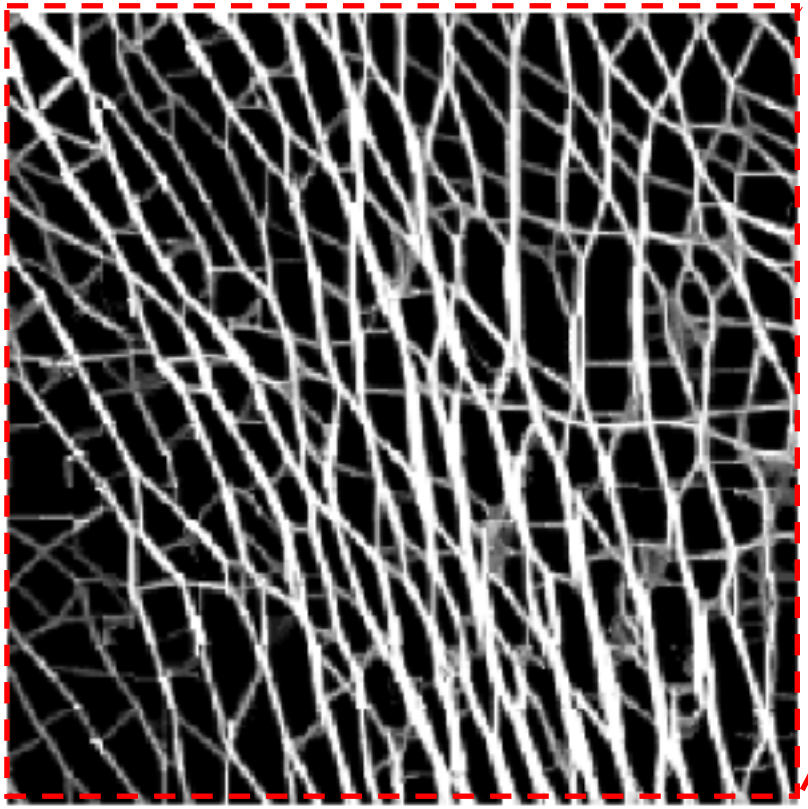


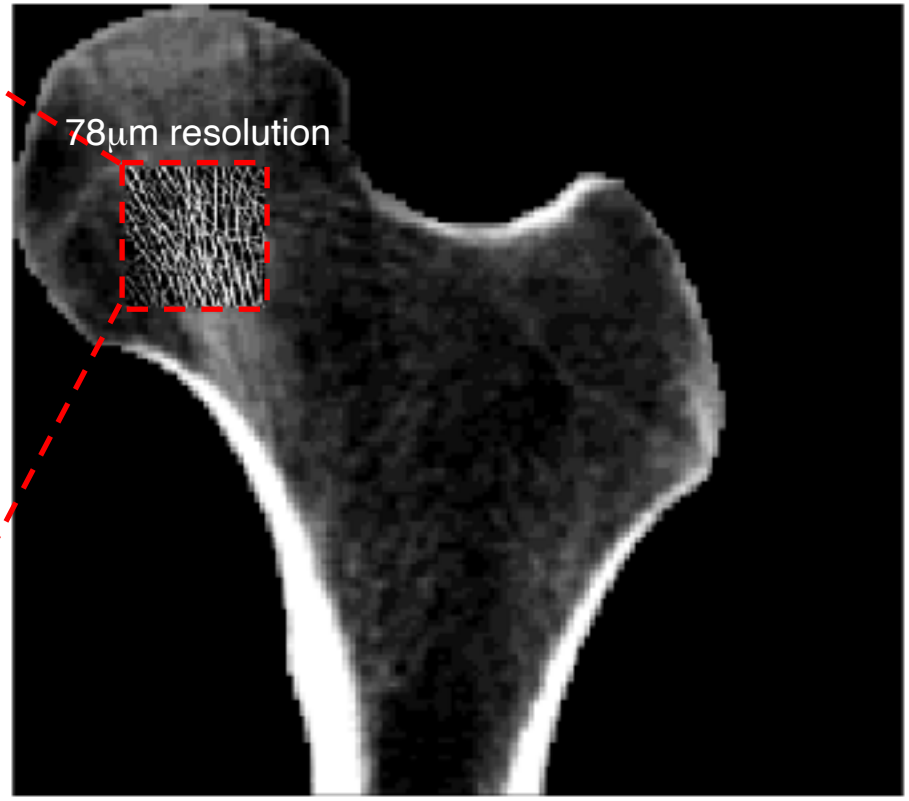
골다공증성 골절

*KAIST 장인권, 계명대 김정진 교수 협업

골다공증 진단을 위한 뼈 CT 사진 고해상화

정확한 골다공증 진단을 위한 저선량 CT 사진 고해상화

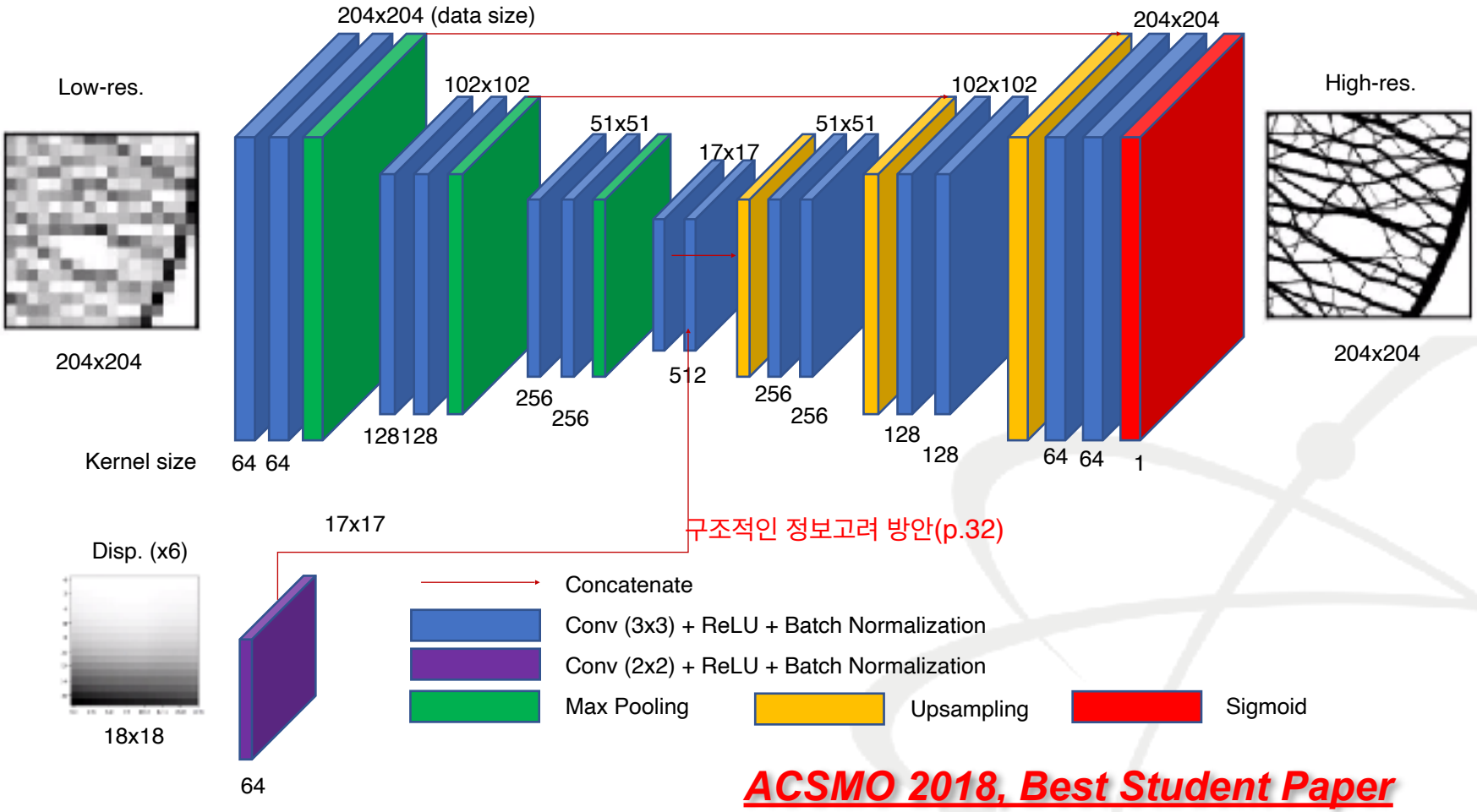




78μm resolution

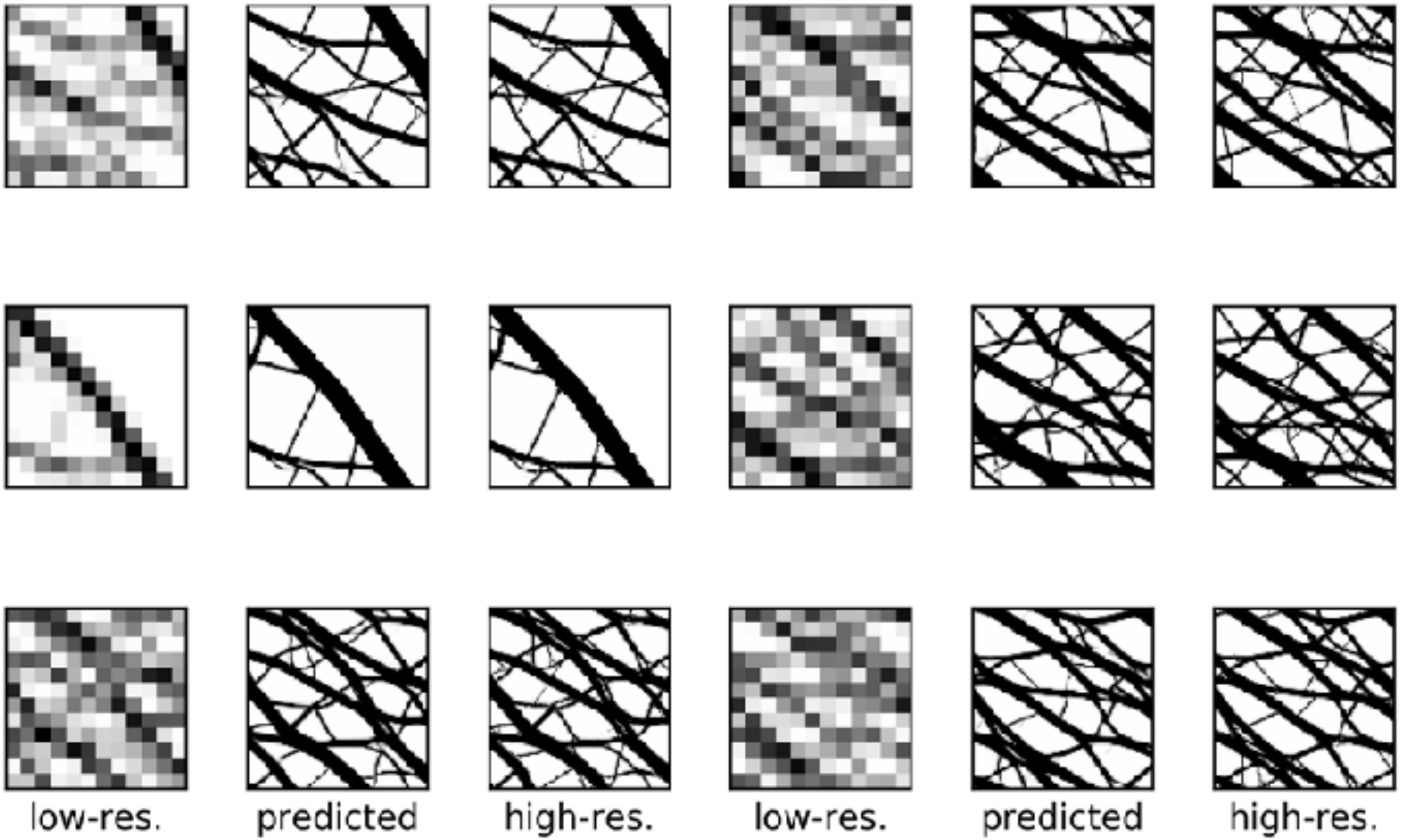
625μm resolution

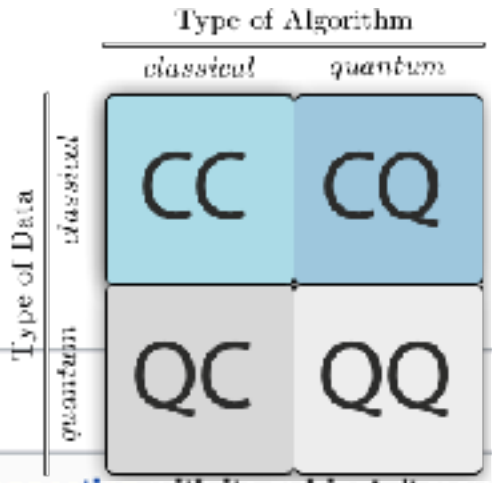
인공지능 기반의 임상 골격계 영상 재구성 알고리즘 개발



ACSMO 2018, Best Student Paper

고해상화 결과 예





Quantum machine learning

From Wikipedia, the free encyclopedia

A major contributor to this article appears to have a close connection with its subject. It may rec
comply with Wikipedia's content policies, particularly neutral point of view. Please discuss further on th
(September 2018) (Learn how and when to remove this template message)

Quantum machine learning is an emerging interdisciplinary research area at the intersection of quantum physics and machine learning.[1][2][3][4][5][6] The most common use of the term refers to machine learning algorithms for the analysis of classical data executed on a quantum computer, i.e. *quantum-enhanced machine learning*.[7][8][9][10] While machine learning algorithms are used to compute immense quantities of data, quantum machine learning increases such capabilities intelligently, by creating opportunities to conduct analysis on quantum states and systems.[11] This includes hybrid methods that involve both classical and quantum processing, where computationally difficult subroutines are outsourced to a quantum device.[12][13][14] These routines can be more complex in nature and executed faster with the assistance of quantum devices.[2] Furthermore, quantum algorithms can be used to analyze quantum states instead of classical data.[15][16] Beyond quantum computing, the term "quantum machine learning" is often associated with classical machine learning methods applied to data generated from quantum experiments (i.e. *machine learning of quantum systems*), such as learning quantum phase transitions[17][18] or creating new quantum experiments.[19][20][21][22] Quantum machine learning also extends to a branch of research that explores methodological and structural similarities between certain physical systems and learning systems, in particular neural networks. For example, some mathematical and numerical techniques from quantum physics are applicable to classical deep learning and vice versa.[23][24][25] Finally, researchers investigate more abstract notions of learning theory with respect to quantum information, sometimes referred to as "quantum learning theory".[26]

감사합니다.

지능형컴퓨팅연구실과 함께 하실 분 연락주세요.